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OBSERVATIONS
ON THE
INFLUENCE OF SOIL AND CLIMATE
UPON
WOOL;

FROM WHICH IS DEDUCED,
A CERTAIN AND EASY METHOD OF IMPROVING THE
QUALITY OF ENGLISH CLOTHING WOOLS, AND
PRESERVING THE HEALTH OF SHEEP;

WITH
HINTS FOR THE MANAGEMENT OF SHEEP
AFTER SHEARING:

AN INQUIRY INTO THE STRUCTURE, GROWTH, AND
FORMATION OF WOOL AND HAIR;

AND REMARKS ON THE MEANS BY WHICH THE SPANISH
BREED OF SHEEP MAY BE MADE TO PRESERVE
THE BEST QUALITIES OF ITS FLEECE UN-
CHANGED IN DIFFERENT CLIMATES.

BY ROBERT BAKEWELL.

WITH
OCCASIONAL NOTES AND REMARKS,
BY THE RIGHT HON. LORD SOMERVILLE.

LONDON:

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ADVERTISEMENT.

TO avoid errors arising from the too general application of particular facts, I was desirous to submit the following pages in manuscript to some person practically acquainted with various breeds of Sheep, and with the effects which different soils and modes of treatment produce on Wool. I am sure my readers will agree with me, that there is no one to whom I could with more propriety refer the Work than Lord SOMERVILLE, whose successful and unremitted attention to the Improvement of Wool is so well known, and whose extensive farming practice in the West of England, in the Southern Counties, and in Scotland, gave him an opportunity of

pointing out any mistakes into which I might have been led, from a local and confined view of some parts of my subject.

His Lordship has honoured the Work with some Observations, particularly on those facts which, from his own experience and practice, appeared to him to require a more limited and qualified application of the general principles than that which I had given to them. The attention which his Lordship has paid to the subject, proves that nothing connected with improvements in rural economy is considered by him as undeserving regard.

The Remarks of Lord SOMERVILLE will be found in the Notes marked with the letter S.

PREFACE.

DESCRIPTIONS of the operations and processes of different manufactures, or of the materials on which they are employed, are seldom written by persons practically acquainted with these subjects. Hence, the accounts which have been published in the Encyclopedias, and Dictionaries of Commerce, in our language, are generally more likely to excite the smile of the merchant, or manufacturer, than to extend his knowledge, or lead to any useful improvements. On no article of commerce has this ignorance been more displayed, than on one of the most valuable productions of our native country. Let a person practically acquainted with the qualities of wool, consult any of our best works of reference on this subject, and he will find less correct information than he might expect to obtain, were it the covering of some unknown animal of the Southern Hemisphere. To many of these Writers, the marked distinction between combing and clothing wools, seems to have been unknown, although the difference is not less, with

respect to the manner of their manufacture, and the uses to which they are applied, than the difference between flax and cotton. Nor will the scientific reader be less disappointed than the man of business, should he expect to find in these works any physiological inquiries respecting the structure and growth of wool, or any correct account of its results by chemical analysis.

Such being the imperfect state of general knowledge on this subject, it need not excite surprise, that in the 19th century, some of the properties of wool are little known, or the causes undiscovered by which other of its qualities are injured or improved. Of these qualities, some which have been scarcely attended to, are second in importance only to the fineness of its hair or fibre. I have endeavoured to make this apparent in the following pages, which were written, not to censure, or to supply, the defects of other Writers, but to direct the attention of wool-growers to objects of practical utility, and to point out the means by which the value of English clothing wools may be greatly increased, and an annual saving to a very large amount in the stock of sheep may be obtained.

Should it be found that the management I recommend is not new, this will not lessen its value; for if the practice be of considerable antiquity, its application for the direct purpose of ameliorating the wool, has in no one instance, that I know of, been resorted to, nor has the principle whence its benefit would arise, been understood or explained. Should some future physician, in applying nitre as a remedy for fever, incidentally discover that it was also a certain cure and solvent for the stone, and afterwards ascertain this by decisive experiments, it would not detract from the value of his discovery, to say that nitre had been employed in past ages as a medicine for other disorders. The value of the discovery in this case, would consist in the certain efficacy of the remedy when applied to a new purpose, and in explaining clearly the principle on which it acted, and the manner of its operation. Whether I have succeeded in establishing a plain and simple principle, and directing its application to improve the quality and increase the value of one of the most important productions of my native country, I must leave to the experience of others to determine.

Wakefield, June 1808.



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ERRATA.

P. 34, line 5, for, the quality, *read* the soft quality.

54, l. 12, for olive-oil and butter, *read* olive-oil or butter.

OBSERVATIONS,

&c.

CHAP. I.

On the soft and hard Qualities of Wool, and the great difference in the Value of Cloth made from these Wools, although each sort may be equally fine—On the distinction between Hair and Wool, &c.

SOME of the most valuable discoveries in the useful arts, have been made by a careful attention to a few simple facts, which were too common and obvious to excite curiosity, or attract general notice. We are disposed by habit to overlook what passes every day before our eyes, and to seek in remote causes for explanations of various phenomena, when a little patient

observation would convince us, that the objects of our inquiry are immediately within the compass of our view. This deviation from simplicity obscures our researches, and frequently vitiates our conduct in the more important concerns of life: not only does it retard the application of known facts to the discovery of useful truths, but it prevents the communication of such discoveries when once made, from the fear that they may be thought too plain and simple to deserve public notice.

It may be necessary to premise these remarks, as an apology for directing the attention of those who are desirous of improving the quality of English Clothing Wools, to a manner of effecting it so easy, that it may perhaps be deemed too unimportant to deserve a trial. I trust, however, I can make it appear, that it is pos-

sible, with very little expence, and without any change in the stock or pasture, to increase the value of many kinds of fine wool from twenty-five to thirty per cent. and at the same time to enlarge the fleece, and improve the condition of the sheep.

Having been introduced into the wool business at an early period of my life, one of the first things which engaged my attention was, the remarkable difference in the softness of wools equally fine, but the produce of different districts. The soft, silk-like feel peculiar to some wools, was not then so highly valued as at present, from causes I shall afterwards explain; it gave however a decided preference in the market to wools distinguished by this quality. A little attention to the wool from various districts, soon discovered that the soils most favourable to the production of this soft quality

were, first, the argillaceous; next, the siliceous; and it was well known that calcareous soils, whether limestone* or chalk, pro-

* There is hardly a doubt of the truth of this observation, as far as relates to chalk. I have noticed the harsh properties of wool on this soil, in its first growth after shearing, which could not arise from the effect of the sun alone, but must be attributed also to the chalk with which the wool is impregnated, occasioned by the sheep hiding themselves in holes or hollows on the downs, where the soil is thin, to avoid the fly. If I mistake not, Mr. Ellman expressed himself some years ago of the same opinion. But I cannot agree to this observation as applicable to limestone soils in general. Lime certainly may be burnt from chalk as well as from the limestone: as chalk, it is conveyed into the fleece by contact in its natural state; but limestone, if it does not lie deep below the surface, as is usually the case, is a hard and clean stone, and can communicate nothing to the wool until it is rendered into lime by the strongest effect of fire. This doctrine militates also against the whole of our practice in the western counties. The pile of all my Merino wool, even of the pure

duce wools of a contrary quality, remarkable for their harshness to the touch. In proportion as the above earths preponderate in a loose state near the surface of different soils, their effects on this quality of the wool may be detected, whatever be the breed of sheep from which the wool be shorn.

Hence it did not appear unreasonable

blood, is publicly admitted to be improved; it has been grown constantly on a limestone soil, and the surface of the land manured with lime in each course of cropping, and to the extent of 100 bushels per acre of the best Popple-lime, the quality of which has been ascertained by Mr. Davy, to whom specimens were sent; it has been treated on in his public lectures, and its quality ranks among the strongest of our manuring lime. As the Author speaks so positively of the effect of the limestone on wools, we may conclude that the limestone of Derbyshire and the adjoining counties does produce this effect.—S.

to believe, that the herbage of each district derived from the difference of soil some peculiar properties, which gave to it as the food of sheep, the power of affecting that process of the animal economy by which wool is produced. That some of the qualities of wool may be changed, not by the nature of the herbage on which the flocks feed, but by its quantity, I admit; in this instance, however, I had sought for a cause too remote, and overlooked what may be literally said to lie immediately on the surface. Considering the effect of soils on the softness of the wool as depending on the food, a limit appeared fixed to any improvement of this quality, and the subject was dismissed from my attention.

The investigation of a few plain facts has since convinced me, that this theory is erroneous, and that it is possible to grow wools of

a soft quality on soils the most unfavourable to its production. It may be proper, before I proceed to state more fully to those not well acquainted with the peculiarities of wool, what is meant by the soft silky quality of wool, and woollen cloth; and to shew why it is more highly valued now, than it was even a few years ago. That the subject may be better understood, it is necessary here to make a few remarks on the nature and substance of wool.

From some experiments which I have made, and also from the experiments of foreign chemists, I am well convinced that the substance of wool, in its constituent elementary parts, is the same as the substance of the other animal excrescences, hair, feathers, nails, and horn. Whatever external difference may appear in these

substances, their results by chemical analysis are the same. The external difference consists chiefly in one being solid, the other fibrous ; one hard and elastic, the other less indurated ; hence, more yielding and pliable. In what then consists the difference between wool and hair ? To obtain a clear idea of the nature of wool, and to avoid obscurity, it is necessary to reply to this question. I will venture then to assert, that the distinction between wool and hair, is more artificial than natural : in this, as in many other instances, men have for their convenience given different names to substances essentially the same, because they were rendered capable by some peculiarity, of being applied by art to different purposes.

Wool may be found on some sheep, which, if grown on any other animal,

would be called what it really is, hair : the same animal will produce in other parts of its fleece, true sheep's wool. Some animals, as the Vicuna, the Angora goat, &c. though they produce coarse, long hair, produce also other hair so silky, soft, and fine, as justly to entitle it to be called wool ; being in these qualities superior to the finest Spanish or Saxony sheep's wool. The Yak of Tartary, of which there is a description and plate in Turner's Account of Tibet, appears to be a species of wool-bearing ox. The oxen of Hudson's Bay also, if naturalists rightly inform us, produce a wool finer and softer than the Vigonia or Vicuna wool ; it must be therefore the finest wool hitherto known. The peculiarity which has given the name of wool to some kinds of hair, is the smallness, softness, and pliability of the fibre, whence it is capable of being spun, and woven into a cloth which will felt or mill into one uni-

form texture, and by the process of fulling, will cover the surface of the thread with a pile. When the hair of any animal is too hard and elastic to admit of the same effect being produced by a similar process, we cease to call it wool. Now *some wool has a much nearer resemblance to hair in the hardness and elasticity of its fibre, than other wool equally fine.* Cloth made from such wool, is hard and harsh to the touch, loose in its texture, and the surface of the thread is bare.

Hence, it is much less valuable than cloth made from the softer wools. The difference in the quality and value of two pieces of cloth, manufactured in the same manner from wools possessing the same degree of fineness, but the one from the calcareous, the other from the argillaceous districts, will be much greater than is generally known, or than those not well ac-

quainted with the fact would be inclined to believe.

Nor is the subject fully known to many engaged in the woollen manufacture ; but it is better understood than it was a few years since, and the soft silky quality is now more highly valued. This may be traced to the improvements which the introduction of machinery has effected in the cloth manufactory, and also to the different manner in which fine cloth is now finished. Formerly the manufacturer, in showing his cloth, was more anxious to exhibit the fineness of the thread than prove the softness of the pile. For this purpose he used to scrape off the pile from a small part of the cloth, to display the smallness and regularity of the spinning : since he has been enabled by machinery to spin a small even thread with great facility,

the practice is discontinued. Cloth is now finished without that hard, shining surface, which was given to it a few years since by hot-pressing, which prevented the softness of the pile from being felt. By the present mode of cold-pressing, the softness of the pile becomes immediately perceptible to the touch, and is considered as one of the most distinguishing and essential qualities of a good cloth. The division of labour may also have prevented the value of the softer wool from being sooner known. The wool buyer in the distant counties, and the wool-stapler who sorts the fleece, are generally unacquainted with the cloth manufactory. The Yorkshire manufacturer sells his cloth in the undressed state; it is bought and finished by the cloth merchant, who formerly was unacquainted with the process of the manufacture and the

qualities of wool. If in a promiscuous parcel of undressed cloths bought at the same price, and apparently of the same quality, some were finished much better, and softer than others, it was attributed to lucky chance—the patron divinity of the ignorant. A spirit of investigation is now prevalent, many of the cloth merchants have also become manufacturers, and have an opportunity of observing the effects which the hardness or softness of the wool produces on the cloth in a finished state. From some or all of these causes, the value of soft wool is better understood, and has greatly increased. It may be affirmed, that taking two packs of sorted wool of the same apparent fineness, one possessing in an eminent degree the soft quality, the other of the hard kind, the former will, with the same expence to the manufacturer, make a cloth, the value of which shall exceed the latter full twenty-five per cent.

The improvement of this quality of the wool, must therefore be of much importance to the wool grower and manufacturer. It has hitherto been little understood, or attended to ; to show how it may be obtained, is the principal object of the present work. As connected with the same object, I shall also notice the other qualities of wool, on which the external action of soil or climate have any influence.

CHAP. II.

On the Causes which produce the hard quality of Wool in many parts of this Island.

IF the soft or hard qualities which distinguish wool grown on argillaceous, siliceous, or calcareous soils, be not caused by the herbage on which the sheep feed, to what are we to attribute this difference? I answer, to the chemical or mechanical action of the particles of the soil on the surface of the fleece. This seems hitherto to have escaped due attention; it can however be proved to exist, by a variety of facts which might be adduced; and not only can it alter the quality, but impart indelibly the colour of the soil to the wool. In parts of Gloucestershire, the fleece ac-

quires a deep orange colour from the soil; in Hertfordshire and Warwickshire, and in every district having a red coloured soil, the wool is inclined to a brownish red. The fens of Lincolnshire and Cambridgeshire communicate a dark blueish tint to the wool. Wools on chalk soils are distinguished by their whiteness; and in every district the action of the soil is evinced by communicating its own colour to the fleece, either by insinuating its particles into the fibre, or chemically uniting with its surface*.

* It is painful to offer in illustration of this subject, one's own practice; but least an effect which is sometimes produced, should be deemed certain and invariable, it behoves me to state, that I have repeated proof of the reverse, in the instance of my own Merino ram hogs, which were bred on a red loamy sand and a limestone subsoil; the wool being shorn after the yolk was well up, scoured of the purest white, which colour, being manufactured

The colour thus acquired is as indelibly fixed in the wool, as the colouring matter of an artificial dye, nor can its whiteness be perfectly restored by any process of art hitherto known. I advert to the tint which remains after wool has been scoured clean with soap. Stoving appears to remove it, but it returns again after re-washing, though it is less perceptible than before.

That the same cause can change the colour and also the hardness or softness of the wool, is obvious, from the different effects which the argillaceous, siliceous, and calcareous soils, are invariably found to have on these qualities. This perhaps is no where more clearly shown than in the

into white kerseymere, after frequent washing, it preserves to this day. But the author's observation may be, and probably is, correct with respect to fleeces more coarse and open in the pile.—S.

northern parts of Derbyshire, where the mineral strata are so abruptly broken, that two adjoining farms, separated by a small brook, will not unfrequently be found, one entirely on the limestone, the other on a siliceous grit or sandstone. The difference of the wool on these two farms, from the same breed of sheep, is so distinctly marked, and was even twenty years since so well known, that the farmer would demand and obtain one shilling or one shilling and sixpence per tod more for his wool, when grown upon the latter soil. "My wool is gritstone, Sir, and I expect a better price than my neighbour's, which is limestone," was the language in common use; and its meaning was well understood by the buyer.

The wools of this part of Derbyshire are of an inferior quality, suited to the lower

kinds of hosiery and coarse cloths. The difference in the value between the limestone and gritstone wools, was then about seven per cent.; had the wool been of a fine quality, it would have been considerably more.

It will invariably be found, whenever lime or calcareous earths come in contact with wool, they deprive it of its soft quality by their action on the surface of the fibre. A demonstrative proof of this effect is offered, in the process of separating the wool from the skins by the fellmonger. The pelts are steeped some days in lime and water; the softest wools, when thus exposed to the action of lime, lose their distinguishing excellence, and acquire all the harshness of wools grown on limestone soils. The hard wools have this quality increased by the same ope-

ration; hence the value of skin wool is considerably less than that of fleece wool equally fine. This fact alone is decisive, and proves, that the hardness of wools in limestone districts is occasioned by the external action of the soil, and not by the food of sheep. Nor will it be difficult to ascertain, in what manner the lime acts upon the wool: it absorbs the natural grease or yolk of the fleece, and forms with it an imperfect soap, which is miscible with water, and easily washed away by the rain. The wool, thus deprived of the unctuous cover intended to keep it soft and pliable, is exposed to the air and rain, and the staple is laid bare to the caustic operation of calcareous earth.

Argillaceous or clay soils are more favourable to the production of soft wool. Clays have an unctuous, saponaceous feel.

and they possess not the caustic absorbent qualities of lime. Sandy soils may fill the fleece with siliceous particles, but these particles will not combine like lime with the yolk, and absorb the unctuous covering of the wool. In the process of the fell-monger above stated, the same effect is produced in a few days by the application of lime in a more caustic state, as that which takes place from the slow but constant operation of the limestone soil on the growing fleece. A similar change also takes place on shorn wool kept long in a very warm and dry temperature; the fibres become indurated and elastic, and acquire the properties of the hard wools. The greater the degree of warmth, the more speedily will the effect be produced. If wool be exposed for a few minutes to a degree of heat just below what would scorch and discolour it, it will never regain its for-

mer state of softness and pliability. The useful arts may here receive an illustration from the curling irons of the friseur, or the more durable effects of baking the hair, practised by the peruke-maker. It is twisted round small tubes or pieces of tobacco-pipe, and kept in an oven moderately heated, by which it becomes sufficiently hard and elastic to retain a permanent curl. It is well known to cloth manufacturers, that wool which has been shorn three or four years, will not spin or felt so well as when kept only one year. A dry situation is necessary for the preservation of wool, but after a certain time, it loses the natural moisture of the fleece, and becomes hard, like the wool from limestone districts.

Dr. Parry says he is informed by the cloth manufacturers in the west of Eng-

land, that in very hot dry weather, they cannot make a piece of cloth from Spanish wool so good in appearance by nearly two shillings a yard, as it would be if made in a cooler, moister season. He adds, “so far as I can learn, the heat and drought render the wool more intractable and elastic.” In Yorkshire, it is well known that cloth dried in hot weather, or in an overheated stove, will not finish so well, or feel so soft, as that which is dried by a more moderate degree of warmth, and in a moister state of the atmosphere.

The similar effect of heat on hair and wool, if not immediately connected with the object of this Treatise, may furnish an illustration to what I shall have to offer in the next Chapter; and will afford hints not entirely useless to the wool-grower. I have before stated, that wool, hair, fea-

thers, and horn, are animal excrescences of a similar nature: were I allowed to hazard a conjecture with respect to their formation, I would say, that they were all secreted from the same fluid, composed of albumen differently modified by the secreting vessels, and thus rendered capable of different degrees of induration; they probably acquire consistence by the absorption of oxygen near the surface of the skin; and I might adduce a visible illustration, analogous to the production of wool from other parts of animated nature, where the process is displayed to our view. The silk-worm and the spider secrete a viscous fluid, which is no sooner drawn out in contact with the air, than it becomes a fine though solid filament or thread (*See Chap. V. on the formation and growth of wool*). Whatever be the truth of this conjecture respecting the formation of wool, I wish it

to be understood, that it is not connected with the facts or inferences of the present Treatise. That the substance of wool is similar to hair, feathers, and horn, I am well persuaded, both from the experiments I have made, and from those of others. If this similarity be admitted, it is reasonable to conclude, they will be acted upon in a similar manner, and rendered harder, or more soft and pliable, by the same causes. I have stated some of the causes which destroy the soft quality of wool, and endeavoured to explain the simple principle on which they act : the remedy will be found to depend on a principle equally simple ; although its application to the present subject has hitherto been neglected. To state this more clearly, and illustrate it by acknowledged facts, will be the subject of the following Chapter. I have purposely omitted to state the inju-

rious effects of extreme heat on the soft quality of the growing fleece; as I intend to confine the first Chapters to objects of practical utility. In our temperate latitude*, this cause can rarely produce any injury. An examination of the African fleeces would, however, change the opinion of those who deny the effect of cli-

* But temperate as the latitude may be, it is still produced. The wool of our Merino sheep, after shear-time, is hard and coarse to such a degree, as to render it impossible to suppose that the same animal could bear wool so opposite in quality, compared to that which had been clipt from it in the course of the same season. As the cold weather advances, the fleeces recover their soft quality. Whether this harsh feel of the wool in its earliest growth arises, supposing that it cannot be the effect of chalk, from the heat of the sun, or the absorption of the yolk, we know not, but such is the undoubted effect; it is probable, however, that it will be more obvious in the finer piles, where the yolk usually abounds, than in the coarser ones, which are destitute of it.—S.

mate on wool. In many of the African sheep, there is evidently a tendency to produce fine, valuable wool, and I have no doubt they would do it, if removed to a more favourable situation. All these fleeces have lost their soft quality, and mill or felt with great difficulty ; the yolk has been absorbed by an arid soil, and the wool nearly baked by a parching sun.

CHAP. III.

On the means by which the soft quality of Wool may be preserved, in every situation, and the effects of Soil and Climate counteracted, where they are unfavourable to this quality—On the preservation of Sheep by the same means—From Cutaneous Distempers—From the inclemency of Climate—From sudden change of Temperature after shearing.

WHEN we consider the changeable temperature, the frequent rains and fogs, the chilling winds, the gloomy skies of Britain, described by Tacitus in the first century (*Tacit. Vit. Agric.*) ; and which still form the character of our climate ; we must admit that our situation is in many respects unfavourable to the growth of wools of the best quality. The fleeces frequently drenched in rain ; their natu-

ral yolk mixed with the soil and washed away; and the animal long exposed to the chilling effects of evaporation, or a sudden change of temperature; all these causes constantly operating, must tend to prevent the production of wool, which may equal that grown from the same sheep, in a drier, and less changeable climate. Fortunately an easy and simple method presents itself of counteracting the influence of these causes, and we must avail ourselves of it, to provide a remedy for the inconveniences of our situation, or in vain may we attempt to rival the flocks of Spain, or Saxony, whatever be the breed of sheep we introduce. The hair may remain fine for some generations, but the soundness of the fibre, and its soft silky qualities will be lost. I am informed that the fine flocks of Saxony, are either clothed or housed in winter, to keep the

animal warm, and the wool dry and clean. In Spain the attention given to sheep, by changing their situations with the seasons, is well known; and the advantage which the wool receives by the animal being kept in a more equal temperature is considerable (*Vide conclusion of Chap. IV.*); but in England, where great attention to external causes acting upon the animal is more requisite, it is generally neglected. In the northern counties, and in Scotland, the inclemency of the winter impels the shepherds to provide some defence for their flocks; but it is done to preserve the animal, with little attention to its effect on the wool. It will be shown, that the increase and improvement of the wool, and the preservation of the animal, may be ensured by the same means, not only in the northern counties, but in every part of our island; and that

in all situations, the wool may also be defended from the injurious effects of a calcareous soil.

The similarity between wool, hair, feathers, and horn, stated in the last Chapter, may seem to be an inquiry more interesting to the physiologist than the wool-grower ; it is however immediately connected with the object of the present Treatise. I was led to the application of it, by observing the well known effect produced on human hair, when daily washed with soap and water, and comparing it with the same hair washed less frequently, and sometimes rubbed with an unguent, as oil or pomatum. By the former practice it became hard and bristly, by the latter it was rendered soft and pliable. A little time after, an intelligent clothier in my neighbourhood, who

kept a small flock of fine woolled sheep, informed me he had adopted the reprobated practice of our more northern farmers, of rubbing the sheep with a mixture of butter and tar. He could speak decidedly to the improvement the wool had received by it, having superintended the whole process of its manufacture. The cloth produced was superior to what ungreased wool could have made, if equally fine; it was remarkably soft to the touch, had what he called, "a good bottom, a good top, and a good hand, or feel," viz. the appearance of the threads were nearly lost in a firm even texture, covered with a soft full pile. The resemblance between wool and hair, already mentioned, presented to my view the cause of this amelioration. The wool had been defended from the action of the soil, the rain, and the air, on its surface, and had

been kept soft, moist, and pliable, by constant contact with the unctuous mixture. Reflecting on the well known power of unguents to soften hair, horn, and other animal substances, it appeared surprising that its application to wool for the same purpose, had not been more generally practised. From the similarity of wool to these substances, it occurred to me, that covering the fleece with unctuous matter, would, in almost all situations, improve its quality, and this in a degree greatly beyond what the simplicity of the means would at the first view induce us to believe. A further investigation has given me the most ample and satisfactory proofs of the truth of this conjecture, and has enabled me to state *as a general position*, that by the application of a well chosen unguent, wool may be defended from the action of the soil and elements,

and improved more than can be effected by any other means, except an entire change of breed.

Not only will the quality of the wool be ensured by this practice, but it will become finer, and the quantity will be increased: it is also found to preserve the sheep in situations where they would inevitably perish, without this defence. Where the practice of greasing the sheep has prevailed, the great quantity of tar which was always combined with the unguent, prevented the advantages of its application to the wool from being discovered; and the breed of sheep on which it is most practised, is naturally the worst which exists in Britain for the production of wool. It is only in Northumberland, and in some parts of the neighbouring counties, that flocks of fine woolled sheep have received

the benefit of greasing with a mixture, in which the tar used was merely sufficient to give it tenacity. The ignorance or the selfishness of the wool-buyers, for a long time prevented the acknowledgment of the advantage which the wool received from the ointment. Many were afraid to purchase it, from the extra weight of grease in the fleecce, and made its dirty appearance a pretence for reducing the price below what ought to have been allowed for the weight of the ointment it contained. The nature of this wool is now better understood; when sorted, it is purchased by the manufacturers of coloured cloth, in preference to any other. The same preference is given to the cloths when sold in an unfinished state, in the Yorkshire cloth-halls, and they always have a ready sale, whatever may be the general depression of trade.

When these cloths are finished, their superiority is still more apparent. I am informed from authority which I cannot doubt, that many cloths made from greased Northumberland wool, have been sold as cloths made from good Spanish wool, and have equalled them in their texture and softness: ungreased wools equally fine, and manufactured in the same way, would have made a cloth, the value of which would not have equalled the former by at least thirty per cent.

These wools appear to improve and become finer in every process of the manufacture; the hard wools, on the contrary, appear to grow coarser by the same treatment. The difference, in this respect, is greater than could be supposed by persons unacquainted with the manufacture of each sort.

Still the improvement which the wool receives from greasing, is scarcely known; nor has the plain and simple principle whence this advantage is derived, been understood or attended to. The practice of rubbing sheep with an ointment, is indeed of high antiquity; but in the time of Virgil, as well as in the present day, it was applied merely to prevent disease, or preserve the animal from the inclemency of the seasons. Virgil informs us in the third Georgic, that the shepherds of Italy greased their sheep immediately after they were shorn, and enumerates the ingredients used in the composition of their ointments, which were well chosen, to prevent or remove cutaneous distempers, and differ not greatly from those used at the present day.

- “ Aut *tonsum* tristi contingunt corpus amurcâ
 “ Et spumas miscent argenti vivâque sulfura
 “ Idæasque pices et pingues unguine ceras
 “ Scillamque helleborosque graves nigrumque bitumen.”

GEO. lib. 3.

The dregs of olive-oil supplied the place of butter, and wax was an excellent ingredient, for which our Northern shepherds have substituted tar. It appears, however, that tar, petroleum, sulphur, and mercury, or a metallic oxyd, were also used, and hellebore was employed for the same purpose for which tobacco is now usually applied to sheep. The practice is generally reprobated by writers on wool. By wool-dealers, greased wools were always spoken of in terms implying their inferiority. In Northumberland, where the wool is rendered superior in softness to the wool of any other native breed of sheep in the kingdom, by the application of an

unguent, even there its effects on the wool are not sufficiently known, and the operation is delayed till the approach of winter. By this delay, the upper part of the staple is deprived of the advantage of being kept in a moist soft state during the heats of summer. When the operation of greasing has taken place, a perceptible improvement may be observed in the wool which is afterwards grown. The line of distinction is clearly marked by the stain which the unguent leaves in the staple; the bottom part of which, where it has been applied, is finer and softer than the upper part which was grown before its application. This difference is so great, that a careful examination of the fine greased wools of Northumberland, might be sufficient to demonstrate the advantage of the practice, and the inconvenience arising from delaying the ope-

ration to the end of the year*. It is evident, if what I have stated be correct, that to

* A certain length of pile is supposed to be necessary, in order to form that shed or shelter for the purpose of turning off the rain and snow, which is the object of this operation. There is an argument in the Author's favour, arising from the bad tendency of the present practice when much tar is used in smearing sheep, the natural effect of which must be, that a considerable portion of the spine or back bone will be exposed to the rain and snow, which, next to the belly, is the most vulnerable part of any animal. In this last view of the subject I am led to prefer the practice of smearing at an earlier period than is commonly practised, and to approve of it, provided a substitute can be found for the tar, which is difficult to be extracted in scouring, and by the Author's own account, limits the wool so smeared to the manufacture of coloured goods alone. Smearing is to be considered as an artificial substitute for the yolk. Merino sheep possess it in abundance, the finest of the British piles have it partially; the coarsest of our short-woolled sheep, unless in a fatting state, have it not. The practice must be governed by circumstances.—S.

obtain all the advantage of the unguent, both to the wool and sheep, it should be applied immediately after shearing, and again at the approach of winter. By the first greasing, the wool will be covered and defended from the action of the soil when the particles are most pulverized and active, and it will be kept soft and moist during the parching heats of July and August. I have also reason to believe, that the top of the staple would not become harsh and discoloured, which is frequently the case with English wool.

One of the acknowledged advantages attending this practice must not be overlooked. The ointment destroys the sheep tick, and has a tendency to prevent cutaneous distempers, and preserve sheep from the bite of the fly. Independent of all consideration of comfort and ease to

the animal, a considerable quantity of wool will be saved, which is torn off by sheep when rubbing themselves against trees or fences to allay the irritation of the skin occasioned by these causes. I am also inclined to believe, from an examination of the greased Northumberland fleeces, that the ointment, by keeping the skin in a soft state, is favourable to the production of finer wool, from the small wool forming pores or vessels which are closed, or cease to act, when the skin is more exposed to the air and soil, and that thus the pile is grown closer, and a larger fleece is produced. I wish it to be understood, that I state this rather as my own conjecture, than from a certain knowledge of the fact: circumstances which I shall have occasion to mention in treating of the formation of wool, may render the probability of this idea more apparent. During the

whole summer months, were the back of a sheep close shaved, and exposed to the rays of the sun, I apprehend that many of the finer fibres of the fleece would cease to grow, and that others would be enlarged, bearing a nearer resemblance to hair, as is the case with some sheep between the tropics.

With all the defects in the present manner and time of greasing sheep, its advantage to these animals in exposed situations is undeniable: many thousands are preserved where they would not have existed without this defence against the severity of winter. A proof of the superior warmth and dryness which sheep enjoy that have had the benefit of the ointment, may be seen on the mountain sides, where greased and ungreased sheep browse together. In a *winter's* day, when the fleeces of the un-

greased sheep are whitened over with snow, or the hoar frost, the fleeces of the other will be seen entirely free and uncovered; either the ointment had prevented the particles of moisture from lodging in the fleece, or they had been thawed and dissipated by the superior warmth of the animal. Is there a county in England where the winter is so mild, that such a covering would be of no advantage to the sheep? On the contrary, I have no hesitation in saying, that in every part of the island, the application of an ointment to sheep would be of more advantage both to the animal and the wool, than the natural yolk of the fleece, were this much more copiously supplied than it is ever found to be in any of our native flocks. The ointment resists the action of moisture more powerfully than the natural yolk; the latter is easily miscible with water, and washed away, and

the sheep are thus exposed to the continued chilling effects of evaporation from the surface of the skin. The advantage which the animal derives from the ointment cannot be doubted, but whilst it has been supposed that the wool was injured by the practice, we are not at a loss to account for the little progress the practice has made amongst flocks producing fine clothing fleeces. In Northumberland this prejudice is surmounted, and the grower finds that his greased wool, with all the extra weight of the mixture, will obtain as good a price, and have a preference to ungreased wool of the same quality. The practice is there rapidly extending, and its advantages acknowledged, contrary to the statement of Mr. Luccock, who asserts, that "the practice of smearing the wool with a dirty mixture of tar and butter, is not necessary to the health of the flock, or the good qua-

lity of the fleece." He further says, " the practice is on the decline," and manifests a wish that it was discontinued. He admits, that " softness is the characteristic of the Northumberland fleeces, and gives a silky texture to cloth, which is scarcely to be imitated by any other wool." " In point of softness," he adds, " I believe these fleeces stand unrivalled among the produce of Britain." Admitting the effect, Mr. Luccock is not disposed to admit the cause which produces the extraordinary softness; this, by the fairest and most undeniable inferences, must be traced to the application of an ointment. The upper lands of the county of Northumberland may be as favourable to the production of soft wools as many parts of Nottinghamshire or Norfolk, but the superior softness of the wools of that county is occasioned by the artificial covering given to the fleece.

Mr. Luccock has evidently written under the influence of the generally prevailing prejudice against greased wool; had this not been the case, he could scarcely have closed his eyes to the evidence which he has brought in favour of this practice, in his excellent Treatise on Wool. I shall extract a remarkable instance which he has given of the effect of greasing wool, and the benefit which it received; yet he attributes the superiority to climate, food, and treatment; but if this were true, it may be asked, why were not the fleeces of the ungreased sheep on the same farm equally soft, which had been longer exposed to the same climate, and received the same food and treatment?

The following passage from his Essay on Wool, page 169, is deserving serious attention. "In the course of business, I once

met with a small parcel of wool, collected from sheep of Westmoreland, which had been smeared according to the custom of that country, with a mixture of tar and grease in the autumn; driven into Huntingdonshire, and pastured during the winter and vernal months upon the warmer soils of that southern district. In this part of the kingdom, tarred wool was quite a novel article, and the impossibility of abstracting all the filth from the upper part of the staple, by the common mode of working it, alarmed the proprietor, who like an honest man, wound the fleece with the leech outwards; a practice neither common in that country, nor adopted by the same farmer in the other part of his parcel, in order that he might more effectually conceal the dirt. These rejected fleeces, however, which passed from hand to hand, because unfit to be mingled

with the common pile of the neighbourhood, were finally sorted in my possession, and contained the softest wool of English growth that I ever examined. Its staple was perfectly free from kemps and wild hair, so common on the backs of northern sheep, and it was much finer than the wool usually found either in Westmoreland or Huntingdonshire; but it was too long for the card, and too tender for the comb; in other respects, it possessed almost every valuable quality. No means presented themselves of ascertaining the precise effect produced by the change of climate, food, and treatment, which these sheep had most probably experienced; but the facts just stated, lead us to conjecture that it was very considerable, and extremely beneficial. They induce us to wish that the experiment were repeated with more accurate attention to the flock, especially

as the increase of softness in the southern wools is most sincerely to be wished."

It is not a little remarkable, that in the same book in which the superior excellence of greased wool is thus described, we should be informed that it possesses almost every bad property, and that it produces cloth of an inferior value. It is right however to state, that Mr. Luccock informs us, he does not relate this from his own experience, and the value of this wool was not so well understood in 1805 as at the present time. Although I do not agree with Mr. Luccock in some of his opinions, I consider his book as the best which has appeared in our language on English wool, and the only work in which an account of our native fleeces is given with any accuracy. The work is well deserving the attention of all who are

desirous of obtaining information respecting the different kinds and qualities of English wool: those who are already well acquainted with a subject so little understood, will best appreciate and most readily acknowledge its merits.

The manner of preparing the ointment in Northumberland is as follows: from sixteen to twenty pounds of butter are placed over the fire and melted, a gallon of tar is then added, and the mixture is stirred with a stick, until the two substances are well incorporated, and form a soft, tenacious ointment. Some skill is required in the application of the ointment, the ignorance of which has prevented the extension of the operation in many places. *If the ointment be merely rubbed on the wool, it collects in the top of the staple, attracts and mixes with the soil, and is rather in-*

jurious than beneficial to the fleece. The proper method is to divide the staples with one hand, and apply the ointment to the skin with the finger of the other hand, by which means the ointment is kept constantly soft by the warmth of the skin, and is equally diffused through the fleece. Attention to this trifling circumstance, is of the greatest importance to the success of this practice. The quantity of the mixture laid upon the sheep, varies with the size of the animal, and the practice of different farmers. In the lighter mode of greasing, one gallon of tar and twenty pounds of butter will be sufficient for forty-five or fifty sheep. Some piles of fine fleeces from Scotland, which I have lately seen, have been greased in the improper manner here described, by laying the ointment upon the wool, instead of applying it close to the skin: the benefit

of the application is thus lost to the wool, and the upper part of the staple rendered useless. An inspection of a few fleeces greased in the best and worst manner, would prove most clearly the advantages of this practice, and how its misapplication might be avoided. It were to be desired that a cheap substitute for tar could be found, because if used in a considerable quantity it communicates a dark tinge to the fleece, which renders it unsuitable for the brightest dyes, or for those goods which are finished white, as blankets and stoved cloths; on which account, I would recommend a quantity of bees-wax to be melted with butter, hog's-lard, or olive-oil, and if any tar be used, that it should not be in a greater proportion than one quart to ten pounds of the mixture. In mild situations, where the sheep are well sheltered from the rain, or where they feed

on soils that have neither lime or chalk, a less tenacious ointment may be used, and tar discontinued as an ingredient in the composition of the unguent.

By substituting wax for tar, the prejudice which exists against greased wools, will be removed in a great degree, and the advantage of the practice obtained. Those who are unwilling to make the experiment fully, might still greatly improve their flocks, by a slighter application of a thin ointment of olive-oil and butter, immediately after shearing; this would preserve the animal from the effects of sudden exposure to cold winds, and be of essential service to the wool, though it would not produce all the benefit which might be obtained from a more tenacious ointment.

Since the preceding observations occurred

to me, I have been informed that several intelligent farmers in the North, have anticipated the recommendation to apply an ointment at such a time to sheep. Immediately after shearing, they rub a small quantity of olive-oil on the skin, which is found to be of great benefit, both to the wool and the animal; the application of tar and butter is made at the usual period with increased effect. Here it may be proper to notice an account I have read in the newspapers, that a person in the West of England, had discovered a composition which cured the scab in sheep, and also increased and improved the wool. This was stated to be a mixture of hog's-lard, butter, and sulphur, applied to the sheep, on which it was to remain three or four days, and then be carefully washed off with salt and water. The proposer of this mixture (which is, in fact, as ancient as the

the days of Virgil), seems entirely ignorant of the principle whence the improvement to the wool is derived, and has done what he could to counteract its influence. Sulphur and salt may be efficacious in curing the scab in sheep, but it is the unctuous matter only, that is of service to the wool. By washing it away, he would entirely destroy its effect. It happened however, contrary to his intention, to remain in the wool, for salt and water will not easily combine with animal or vegetable oil, or wash them away from the fleece. To this portion of the ointment thus adhering to the wool, we are to attribute any improvement which it received. It is a circumstance corroborative of the arguments in recommendation of the practice of greasing sheep, that those who have given us receipts for the cure of any cutaneous distempers to which sheep are liable, have

been generally obliged to mix their drugs, whether metallic oxyds or minerals, with some unctuous matter; and they have almost always informed us that their prescriptions not only cured the disease, but improved the wool. The latter assertion, I believe, was true, nor could it be otherwise, if what I have stated be correct, unless the drugs employed were of a very corrosive nature, and destroyed the softening effects of the ointment.

I have hitherto omitted to notice the improvement which combing wools may receive from this practice. Those acquainted with the different processes of carding and combing, and the difference between worsted and woollen goods, will not expect that the former will be equally improved with the latter, by having the wool greased. Softness is not the chief excellence of

worsted pieces, but fine, even spinning. Some experiments, however, which have been lately made on the finest greased combing wools, have produced a superior top, and yarn, to any ever before made from wool of the native English breed. An intelligent manufacturer also informed me, that combing wools of an inferior quality, when greased, made superior pieces to ungreased wools of the same quality. Formerly he purchased his wools upon the Yorkshire Wolds; since they have been enclosed, and the sheep have had good winter food, and are thereby enabled to resist the severity of the climate, many farmers have discontinued the practice of greasing, which was resorted to, as in other parts of the North of England, merely to preserve the sheep, and which was supposed to make the wool less valuable. This error, the same manufacturer acknowledged he had

encouraged, that he might purchase it at a reduced price; but he observed, that were he a farmer in that part of Yorkshire, he should continue to grease his sheep, both to preserve them from wet and cold, and to improve the wool. It is really surprising, that in England, where such great and laudable exertions have been made to improve clothing wools, by a mixture of the Spanish breed with our native flocks, that so little attention has been given to the action of external causes on the unshorn fleece. An opinion has prevailed, that wool and hair have some degree of vitality, and receive nourishment from the circulating fluids of the animal. This opinion I am well persuaded is erroneous (*Vide Chap. V.*); and has led to some errors in the management of wool. It has induced many to suppose, that when this substance was produced, no farther care was neces-

sary for its preservation, except such as they were obliged to give it, in attending to the health of their flocks.

In rainy seasons, and on some soils, the yolk is washed away or absorbed faster than it can be re-produced. In such situations, the fleece receives nearly as much injury, as shorn wool would suffer if exposed for a long time in an unwashed state to the action of rain. No person will deny that such exposure must injure or destroy many of the valuable qualities of wool when separated from the back of the animal; yet it is generally expected, that fleeces which during their growth have had no covering or protection, should be as soft and valuable, as those which have been sheltered and defended from the influence of rain, heat, and soil.

CHAP. IV.

Improved Methods of Washing Sheep—On the means of preventing the Deterioration of Wool in the Spanish breed of Sheep—On the Qualities and Defects of the finest Fleeces from Saxony—On the influence which Pasture, Heat, Cold, and Moisture have upon the Staple—Different effects of the Climate of Spain and England upon the Fleece.

IT may be of use, briefly to state some of the inferences to be drawn from what I have advanced, to recommend the practice of applying an ointment to sheep; and also to arrange in a short compass, some of the positions I maintain, distinct from the recital of the facts by which they are supported.

1st, That hair differs from wool, by the

greater degree of hardness and elasticity of its fibres.

2d, That some wools resemble hair in this quality more than other wools which are much coarser.

3d, That the hard quality found in some wool, prevents it from making cloth of the same value as the softer wools, if the former are considerably finer than the latter.

4th, That the application of unctuous matter sufficiently soft and tenacious to cover and remain upon the fleece, will defend it from the action of the soil, and is found to produce the soft quality of wool, so desirable to the manufacturer.

Hence the greased fine wools of Northumberland and Yorkshire, possess a su-

perior degree of softness to any ungreased wools in the kingdom.

Hence sheep that have received the benefit of this practice, and are driven into other counties not remarkable for soft wools, still preserve the distinguishing softness of their fleece. Hence we learn the reason why ointments, when casually employed to cure some disease of the animal, have also generally been found beneficial to the wool.

If these facts and inferences be admitted, we may also infer, that an improved method of greasing fine-woolled sheep should be adopted in every part of the kingdom, and that it would greatly improve the quality of the wool, and annually save many thousand sheep from perishing by the severity of the climate.

The only objection against the general introduction of the practice, will be found in the prejudice or ignorance of wool-dealers, unaccustomed to purchase greased wools, and unacquainted with their real value; for whatever may be their excellence, if the wool-stapler be afraid to purchase them, the growers will not venture to introduce the practice. The greasing I recommend is indeed very different from the smearing with tar, practised in the North of England; and were the sheep well washed, it would scarcely be perceived. Should some portion of the ointment remain in the fleece, it will not be difficult to ascertain the abatement of price which should be allowed for it. I have no doubt, however, that the superior excellence of the wool will more than compensate for the extra weight of the ointment. An easy method of ascertaining the real

quantity of ointment contained in each fleece, is offered, by taking an equal weight of the greased and ungreased wool, after they are washed and skorn, and scouring them clean with soap and warm water, and then weighing the neat wool in each lot. The fine wools of Northumberland, in the greasing of which, one gallon of tar has been combined with 20 lb. of butter, sell, when the fleece is sorted, for an equal price, and have a readier sale than the ungreased wools, which would not waste so much in scouring by 25 or 30 lb. per pack of 240 lb. If a pack of Northumberland greased wools will make less cloth than the other, its value will be greater, and thus compensate the manufacturer. I am supposing that the two sorts are equally fine. To the noble and distinguished characters, who have contributed so much towards the amelioration of the

wools of Britain, I look for the introduction of the practice in the midland and southern counties. Let them try the experiment on a part of their South Down, or other flocks ; let a part of the wool be sorted, and sent with some ungreated wool from the same flock, equally fine, to an unprejudiced manufacturer ; let each be manufactured into a piece of cloth, and I am confident, if the trial be fairly made, the result will confirm all I have stated in the former part of this Treatise.

Let the sheep intended to be greased, have a thin ointment of olive oil, butter, or lard, made into a soft pomatum, and applied to the skin immediately after shearing, particularly on the back and sides of the sheep. The second application in November, will require more care, and an unguent of greater tenacity. I repeat it

again, that to make the experiment succeed, the ointment must be laid close to the skin, by opening and dividing the staples with one hand, and applying the mixture with the finger of the other hand. Limestone or chalk soils will make a larger quantity of the ointment, or a more frequent application of it necessary, to preserve the wool soft. In situations much exposed to rain, a small portion of tar might be added, with advantage to the mixture, on account of its tenacity; but if bees-wax be also employed, a much less quantity of this dingy ingredient will be necessary than what is used in Northumberland, perhaps not more than one quart to sixteen pounds of butter. With a judicious attention to these precautions, the prejudices against the use of an ointment will be removed, and an essential benefit procured to the native flocks of our Island.

The value of the wool will be greatly increased, and both the finer and coarser cloths of Britain will be made to equal, or exceed in softness, those of any other country. The number of sheep that may be annually saved by this practice, makes its introduction of importance, as an object of national economy. Nothing is wanting to extend generally the application of an ointment to sheep, but a clear idea of the plain and simple principle whence its advantages arise, and a knowledge of the facts which prove its beneficial effects*. That it will sooner or later be every where applied to the short-woolled sheep of Britain, I am fully persuaded; the ointments,

* It is probable that yellow ochre will mix well with the oil or butter; it is a greasy clay, its colour is that of the wool itself; it has for a very long time been used in Spain in its natural state, with a view perhaps to produce this effect.—S.

and the modes of application may be changed; but the practice will remain so long as the soil and climate of our Isle remain nearly what they are at the present time.

To remove all objections against greased wools, I would recommend the same manner of washing sheep in tubs with warm water, as is practised in Sweden. It would be desirable that the Spanish and mixed breeds of sheep were also washed in this way, because it is not possible to cleanse the fleece by the usual practice of immersion in a river, without keeping the animal a long time in the water, and thereby endangering its health. Indeed, I do not think the Spanish fleeces can be cleansed by the usual mode of washing, on account of the closeness of the pile. Were the Spanish sheep in this country washed be-

fore shearing as clean as the English, the value of their wool would be better ascertained by the wool buyer, and a more general competition of purchasers would always ensure a fair price for the article.

The extra labour required to wash sheep in tubs with warm water, and lees or soda, would, I apprehend, be amply repaid, were the water of the first and second washings carried out and applied as a manure. The quantity of rich natural animal soap it would contain, must make it one of the most fertilizing applications which could possibly be used. The greased wool would require a greater quantity of soda to cleanse it, than that of the Spanish, or mixed breeds, where no ointment had been applied. I shall annex Baron Schultz's account of the Swedish manner of washing sheep: I think some improvements upon

it will suggest themselves to the intelligent wool-grower.

“ Before the shearing, the wool with us is almost universally washed upon the sheep. Some persons wash their sheep in the open sea, or in running water, but this is never so clean, as when the sheep are first washed in a large tub, with one part clear lee, two parts lukewarm water, with a small quantity of urine ; and then in another tub, with less lee in the water ; after which the sheep are washed, laying them always on their back, with their heads up, in a tub with clean water ; and lastly, there is poured on the sheep, standing on the ground, a sufficient quantity of water, which is as much as possible squeezed out of the wool. The sheep are afterwards driven into an unpastured adjoining meadow, and remain there (to prevent their

soiling themselves in the sheep-house) a day and night, not only till they be dry, which in good dry weather happens within the third day, but also, if bad weather does not threaten, some days longer. Some persons wash their sheep twice, which I also once tried, but the wool became rougher in consequence of it, and in fact of a greyer appearance. The great quantity of grease which the finest Spanish wool contains at the first washing, mixes with the lee water, and makes it quite soft and soapy; but this grease is wanting in the second washing, so that the water is not in the least softened. If the first washing be well performed, the wool is by that means several per cent. cleaner than the foreign wool that is imported, which has not been washed after the shearing."

The following table will offer a state-

ment of the quantity of neat wool contained in every hundred pound, in the average state of each sort. Accidental variations, from one to 10 lb. per cent. may sometimes be found; but the general results will not vary much from the quantities here given.

	Pure Wool.	Waste.
100 lb. of English wool, washed in the usual manner by the grower, will contain, when afterwards scoured perfectly clean with soap,	75	25
Saxony fleeces, ditto,	80	20
Spanish R, or Refinos, scoured,	88	12
Spanish and Portugal fleeces, unwashed,	45	55
English fleeces, unwashed,	60	40
Light greased wools of Northumberland, washed in the usual manner,	65	35

In the above statement I have supposed each sort to be free from pitch marks and dag locks, and that the wool is scoured perfectly clean with soap and water; which

will require the water to be changed at least three times.

I have hitherto principally confined my observations to the native breed of sheep on our Island. It will be proper, before I conclude, to advert to the meritorious and successful attempts which have been made by His Majesty, and by Lord Somerville, and other distinguished characters, to improve the wools of England, by an intermixture of the Spanish breed of sheep with South Down and other flocks. These experiments will, I have no doubt, not only increase the fineness, but the softness of English clothing wools, by increasing the quantity of yolk contained in the fleece. In the pure Spanish breed, for some time at least after their introduction, this supply of yolk is so plentiful, that the use of an ointment for the wool may not be neces-

sary. I would however recommend, that immediately after shearing, the sheep should be rubbed on the back and sides with olive oil, or a thin mixture of olive oil, lard and wax, to preserve them from cold and wet after they have been bared, and exposed to the injurious effects of this changeable climate. I have little doubt that this practice would improve and preserve the soundness of the wool. Some writers of respectability have denied the effect of climate on wool. If they had confined their observations to the effects of climate on the fineness or coarseness of the hair, I should so far have agreed with them, that there are no causes operating in the nature of our own climate, to prevent wools being grown in our Island, equal in this respect to those of Spain. There are, however, other qualities on which the external influences of climate and soil can be

proved to effect a change by undeniable facts. These are constantly acting on the surface of the fleece, and claim the attention of the wool-grower.

The experiment of producing fine wool from Spanish sheep, has been fairly tried in Saxony for nearly half a century. I have had in my possession, and carefully examined, many hundreds of these fleeces, which equal in fineness, the very finest Spanish wool I ever saw. The wool is true grown, viz. there is but a very small quantity of an inferior quality in any part of the fleece. It is also entirely free from a coarse silvery hair running through the fleece, common to many piles of Spanish wool. It will spin finer, when carded, than Spanish wool, and is suited for light kerseymeres, pelisse cloths, &c. The price, if due allowance be made for extra waste

and for the wool being unsorted, exceeds this year that of the best Spanish wool. It is sold in England, at this time, for 6s. 8d. and 6s. 6d. per pound in the fleece, which is washed on the back of the sheep; but is cleaner than the general run of English fleeces. In this state, the average weight is nearly one pound and three quarters to two pounds. This may surely afford sufficient encouragement to those who are desirous of improving our fine clothing wools. With the above admissions, I must however observe, that in some valuable qualities, the wools of Saxony are inferior to the Spanish, and I have little doubt this is occasioned by the influence of climate. This wool is less sound in the staple than Spanish wool, nor will it make a cloth of equal firmness and durability. From frequent examination of Saxony fleeces, I am persuaded that their supply of yolk is not

so copious as in the native Spanish sheep, nor is the wool grown so close upon the skin. In general appearances, these fleeces nearly resemble those of the best Norfolk; they are much finer, but a good judge of wool would have no hesitation in saying they were grown on a soil and in a climate nearly similar. Hence it may be fair to infer, that the soil and climate have effected a change, and assimilated them to other wool under the same influence. The want of soundness in the staple would be a great defect in the Saxony wool, for the general purposes of the cloth manufacturer. It may arise from occasional deficiency of food, from extreme cold, or from the fleeces being long and frequently exposed to rain.

To preserve all the best qualities of wool from the Spanish breed of sheep, it will be

necessary to attend to three objects. The first in importance is the purity of the breed, which can only be preserved by the greatest care, and by the nicest judgment in selecting the rams and ewes. Secondly, to observe that the fleece be covered by nature with a copious yolk; and where this is deficient, that it be supplied by art: nor should we suffer the unctuous covering of the wool to be absorbed by a mixture with the soil on fallow lands, or washed away by the rain; to this the ointment will be less liable than the natural yolk. It is also necessary that the sheep be kept dry, and sheltered from the extremes of heat and cold. The third object is, to regulate the quantity of nourishment given to sheep.

The first of these objects I must leave to the intelligent wool-growers. The second I have already adverted to, as far as relates

to the covering of the wool, and it is not my province to point out to the practical farmer the exact manner in which he may best provide a convenient shelter for his sheep; the buildings, however, for this purpose, should have near the roof, sliding doors or windows on each side, to admit air in any direction, and to regulate the warmth. The practice of coting, or housing the sheep at night, was found to be very beneficial to the wool. I am informed by my friend Mr. S. Wilkins, of Cirencester, that where coting has been discontinued in Herefordshire, the wools have considerably deteriorated. I am surprised this practice, so necessary in our climate, has not been more general; and still more so, that it should be relinquished where the growth of fine wool was an object of importance. If there be any truth in what I have hitherto advanced, it is obvious that housing

the sheep at night, and providing them during the day a shelter from the rain and sun, must preserve and improve the wool; and would also essentially conduce to the health, comfort, and preservation of the animal.

The third object to be attended to, is the quantity of food. As a considerable difference of opinion exists with respect to the effect of food on the fineness of wool, and as the question is still *sub judice*, I shall be excused in stating my own observations on this subject. A sudden removal to a rich luxuriant pasture, has a tendency to increase the fleece, and make the wool coarser. I assert this from repeated examinations of its effect on forest sheep removed into pastures to fatten. I believe some breeds of sheep resist this effect more than others, and the Spanish

perhaps more than any of our native sheep*. I have stated that this effect is occasioned by a removal from a poor to a rich pasture. I do not, however, by this mean to assert, that some breeds of sheep will not produce fine wool when plentifully supplied with nutritious food. This may be the case with the Trashumantes, or fine-

* This effect has been ascertained on my own flock for many years past; not only on the Merino and Ryeland, but on the wether sheep of the pure Merino race, to the number, the mixed breed included, of many hundred sheep every year. These sheep have been constantly depastured on very rich marsh land during the summer months, and no degeneracy in the wool has resulted, but on the contrary an improvement; such is the opinion of those who purchased it: perhaps they considered the wool less incumbered with dirt and more full of yolk, and therefore gave it the preference. The causes of this, however, with other details, will form part of a statement to be published hereafter, in continuation of a former work on this subject, which I thought it my duty to make public.—S.

woolled travelling sheep in Spain, which are said by some writers to exceed in fatness the stationary coarse-woolled ones. It is not the absolute quantity of food which animals consume, but the proportion of nourishment each species may contain, that we ought to attend to. If food be supplied in nearly the usual quantity, and be of a kind on which the animal will thrive, it will produce no change in the wool, and it is of little consequence whether it be given in the form of grass, hay, or turnips; whether in enclosures or open fields. I admit with Dr. Parry, that the great and sudden change which appears to take place after enclosures in the quality of wool, is generally occasioned by the introduction of a heavier breed of sheep. Were it the interest of the farmer to grow fine wool in the same situation, he might effect it by a careful attention to the breed, and by

limiting the quantity of food given to his sheep. That the latter circumstance is necessary to be attended to, was the opinion of Mr. Bakewell of Dishley: he said to me the year before his death, "he had no doubt that fine wools might be grown on rich pasture lands by overstocking them, and preventing sheep from obtaining more nourishment than they had been accustomed to." I state this, because I am apprehensive that the opinion of Mr. Bakewell on this subject, has been mistaken by Mr. Turner, who is quoted by Dr. Parry as an authority that Mr. Bakewell did not admit the effect of food or climate on wool. It is probable that Mr. Bakewell had stated, that different kinds of food made no alteration in the wool, for it was not the kind of food, but the nourishment it contained, to which he attributed any effect on the wool. Until the change oc-

casioned by rich pastures on the wool of Spanish sheep be fully ascertained, it would be desirable that they should be supplied with nearly the same quantity of nourishment to which the parent flocks have been accustomed, provided that this be sufficient to keep them in a healthy state. Baron Schultz, in his account of the sheep of Sweden, informs us, that some of their fleeces may be increased from 2 lb. to 4 lb. by an increase of food. M. Fink, although he does not admit that increase of food injures the quality of the Saxony fleeces, yet he allows it will increase their quantity. It must do this either by lengthening the staple, or by enlarging the thickness of the fibre: in other words, it must make the wool longer or coarser; in some instances it may do both. There is one undeniable fact, which may silence every doubt on this subject, as it is not an inference from

any partial or local observation, but is proved by the general experience of wool-buyers in every part of our Island. After a fine open winter, a greater quantity of wool is produced, than when the season has been severe ; in some instances, the difference will amount to full one-fifth of the aggregate weight of the whole quantity of wool grown in the kingdom. The fleeces at such times are considerably larger, but the wool is always coarser ; as the wool-sorter knows by long and constant experience.

The enlargement of the fleece, and the increased coarseness of its hair after a mild winter, are chiefly occasioned by the greater quantity of food which sheep obtain at such seasons, when vegetation has been but little checked by severe frosts. Farmers who have flocks of the long-woolled

breed, and are accustomed to supply their sheep with plenty of food during winter, sometimes trust too much to the mildness of the season, and withhold this supply altogether. Hence some lots of wool are not unfrequently found to be lighter after a mild, than after a severe winter; the fleeces will be jointed in the staple, and finer in the hair near the joint. Such wool is rendered unsuitable for the comb. The farmer is generally willing to acknowledge the cause of this defect. I bring this instance of the effect of increase and decrease of food on long combing wool; because in such wools, the changes they occasion are more striking and perceptible to those unaccustomed to minute and nice examinations of the fibres of wool.

Excessive heat is highly injurious to wool; in our temperate latitudes, it may

be unnecessary to direct the attention of the wool-grower to its operation : but I will however venture to assert, *that in proportion to the regularity of the temperature in which sheep are kept, and to the regular supply of nourishment they receive, will the hair or fibre of the wool preserve a regular, even degree of fineness.* From an observation of the wools of Africa, I am convinced that the arid soil destroys their softness, and the parching heats produce great irregularity in the fineness of the hair. In Portugal, where the same attention is not given to sheep as in Spain, and they are more exposed to the summer heats, the wool is less regularly fine, and more intermixed with coarse silvery hairs. A cool moderate temperature is more favourable to the production of fine wool than excessive heat ; and were the sheep of Spain, like those of England, unprotected

against the effects of climate, I should have no hesitation in saying, that the situation of that country would be in some respects worse than that of our own Island, and more unfriendly to the growth of a fine even staple. But to the other qualities, the soundness and softness of the fibre, our frequent rains are very prejudicial, unless the sheep be sheltered and defended from their effects. This only proves, that greater attention is required to external causes acting upon the fleece than has hitherto been thought necessary in England. With due precautions to counteract these causes when prejudicial, I have no doubt fine wool will continue to be grown in Britain, equal in every good quality to the Spanish or Saxony fleeces. The prejudices of the manufacturers on this subject, must yield to repeated proofs; and the time will come, when they will reflect

with gratitude on the exertions of those distinguished characters in the present reign, who have, by a judicious attention to the breed of sheep, done so much to improve the wool of their native country.

CHAP. V.

On the formation of Wool, Hair, and Silk—Observations of Mr. Leuwenhoeck—On the Roots of Hair—On the felting quality of Wool and Hair—Opinion of M. Monge respecting it—An Experiment to ascertain its Truth—On the Furs of different Animals, and the Causes which occasion the same Hair to be grown coarser or finer at different Seasons—On the Defects of Wool—The jointed Staple—Cotted Fleeces, &c.—The effect of Climate on Wool—Improvement and Application of the Furs of different Animals—On the formation of Feathers—Cause of the Moults—Microscopical Observations—Hints from Nature for the Improvement of Wool.

THE preceding Chapters have been confined to objects of practical utility, and I have endeavoured to avoid the intermixture of speculative inquiries in what has been advanced.

In the present Chapter I shall attempt to bring some illustrations from analogous facts, and to state some microscopical observations, tending to confirm my conjecture respecting the structure and formation of wool. I offer them as hints to excite the curiosity and direct the attention of future inquirers to this subject.

An acquaintance with the formation of wool and the structure of its component parts, could not fail to be of some use, both to the wool-grower and the manufacturer: it might assist the former in his endeavours to improve its qualities, and guide the operations of the latter when he wanted to produce effects depending on some of its properties, which are not clearly understood or sufficiently attended to.

I have stated my opinion, that wool and

hair are formed from the same fluid, but differently modified by the secreting vessels, and thus possessing different degrees of elasticity and induration. I suppose each hair or fibre to be secreted from the albumen by imperceptibly minute vessels uniting in others still larger, till the different filaments secreted from each, are united and collected into one excreting duct near the surface of the skin. The filaments thus collected in a viscous state, probably acquire consistence by the absorption of oxygen, and become a solid fibre or thread, which is protruded in the form of wool or hair. Each fibre, whether of wool or hair, is thus composed of a number of minute filaments, laying parallel, and closely adhering to each other. The adhesion of these filaments in some hairs, is too close to admit them to be perceived by the microscope; in others

they may be distinctly seen, and in the large hairs of some animals, they may even be separated and subdivided to a certain extent.

The formation of silk I believe to be nearly analogous to that of wool, but it takes place externally and visibly. M. Jaquin, professor of chemistry at Vienna, informs us that “silk, the web of all other caterpillars, and the silk of the *barbapinnæ marinæ*, are chemically considered almost the same substance as wool, from which they differ merely because they are less susceptible of colours, and on account of some peculiar properties when dyed.” Mr. Lewenhoeck observed that the spider has five large papillæ, or what he calls working instruments, from whence five threads of viscous matter issue, which immediately unite and become one solid

thread. These five threads are each of them composed of a great number of other filaments inconceivably small, which unite as they are spun out. Mr. Lewenhoeck says there are sometimes not less than four hundred small threads uniting together to form the last thread. The reason of this division of the viscous matter into such minute filaments, he states to be, that it might by such minute division acquire immediate solidity by contact with the air, and also that the thread might possess flexibility; for he adds, "as the spider's web to the naked eye, appears single, yet consists of a great number of other threads, and thereby acquires greater strength; we may from hence conclude that no flexible bodies, except metals, can attain to any degree of strength, unless they consist of long united parts, and the more these parts are twisted or cemented together,

the stronger they are, which is very obvious in flax, silken thread, ropes, &c. And thus also hair or wool, according to its fineness, has more or less strength, because each of these hairs consists of longer and finer parts, which are united by a viscous matter. It is necessary, he observes, to make a thread so strong and thick as those of the spider's web, with the viscous matter thrown out of the animal's body, that it should be divided into a great number of small threads, to be immediately consolidated by the air. One hundred of these small threads will not make one hundredth part of the thickness of a single hair of the head.

On examining the roots of hairs which have been recently plucked out, I have sometimes seen with the microscope, several distinct small fibres uniting and join-

ing at the bottom of the hair. I have no doubt a great many more would have been perceptible, had they not been broken off close to the bottom in separating it from the body. These fibres were nearly transparent. In all microscopical observations on wool and hair, the greatest attention is requisite, to prevent any optical illusion from their semi-transparency. The first appearance of a bright line running up the hair, has induced many to suppose it was a hollow tube. This deception arises from the refraction of the rays of light on the sides of the hair; a solid thread of glass will present exactly the same appearance.

I was not aware, when I first formed this opinion respecting the structure of wool, that it was confirmed by the autho-

riety of that minute and accurate observer of Nature, Lewenhoeck. He says "each fibre of hair and wool consists of long and finer parts united together by a viscous cement, and covered with a crust or bark." This is probably merely the same viscous cement spread over its surface.

The observations of M. Bon, on spiders and spiders' silk, confirm the discoveries of Lewenhoeck. The formation of wool takes place by a slower and more gradual process under the skin of the animal. Silk acquires immediate solidity by contact with the air, owing, as has been before stated, to its filaments being so extremely minute.

The fibres of wool and hair being

thicker, require a longer time to become solid by desiccation, or by the absorption of oxygen. That oxygen can be absorbed through the surface of the skin, is evident from the well known experiment of placing dark venous blood in a closed bladder, and exposing it to the action of oxygen gas, where it acquires the bright red colour of arterial blood, notwithstanding the interposition of the bladder.

The minute vessels which secrete the wool or hair-forming fluid, unite in the excreting duct near the surface of the skin, where the hair or fibre is formed. This duct has the appearance of a bulb in the roots of human hair, with an opening nearly similar in form to the mouth of a trumpet, from whence the hair is protruded. It is not improbable, that the

hair may receive, by the alternate constriction and expansion of the orifice of the duct through which it passes, minute indentations or ridges on its surface, which occasion the roughness we feel when it is drawn through the fingers from the point to the root. To this peculiarity of the surface, M. Monge attributes the felting quality of wool and hair (*See Ann. de Chymie, tom. vi. p. 300, &c.*)

“ The felting of wool or hair, is an effect resulting from the external conformation of their fibres, which appear to be formed either of small lamina placed over each other, in a slanting direction from the root towards the end or point of each fibre, like the scales of fish lying one over the other in succession from the head to the tail ; or of zones placed one upon another, as in the horns of animals ; from

which structure each fibre, if drawn from its root towards its point, will pass smoothly through the fingers, but if it be drawn in a contrary direction from the point towards the root, a sensible resistance and tremulous motion will be felt by the fingers. This peculiar conformation disposes the fibres to catch hold of each other, and as they cannot recede when acted upon by other bodies, they naturally advance by a progressive motion from the end towards the root."

The hairs of wool, when carded and spun, are laid in every direction, and when they are compressed and agitated, this disposition to catch each other, and move from the point to the root, must inevitably bring the whole mass closer together. This is the case when cloth is

fulled or milled, by which it is shortened both in length and breadth. Not being perfectly satisfied with the account given by M. Monge, I adopted a very simple experiment to ascertain its truth: I took a staple of coarse wool, of considerable length, with the hairs laying regularly in one direction. At the distance of an inch from each end, I made a tight ligature with a thread; I measured the middle of the staple between the threads, and then proceeded to mill it, by compressing it with my hand in a solution of soap and warm water. I continued the operation until each end of the staple beyond the thread was felted into a hard knob or button, which could not be separated by the fingers. The middle of the staple remained unfelted, the hairs quite distinct from each other, and it was not

in the least shortened by the process, either in the wet state or when dried. In the middle part of the staple, between the two threads, the hairs were kept in the same direction by being tied, and could not acquire the retrograde motion, or adhere by the surfaces catching hold of each other. The hairs at the end of the staple being at liberty to double and move in different directions, were soon felted together into a smooth hard and round knob, in which the ends or points of the wool were entirely buried.

It is possible that lime may injure the felting quality of wool, by depriving it of its moisture, and making it more elastic; and also by its causticity, it may destroy the extremely minute ridges on its surface, on which its felting quality depends.

The cause of the felting quality of wool and hair is little understood or attended to, and involved in some obscurity; I may, therefore, be excused for dwelling upon it, as it is of considerable importance in the cloth and hat manufactory. That the felting quality depends on the tendency of the hair or fibre to move in one direction when repeatedly pressed, I have little doubt; but whether this is occasioned by indentations, or by rings, or zones, or any inequality of the surface, will not admit of proof, as they cannot be discovered by the microscope, though we can feel a sensible degree of roughness when hair is drawn from its points to the root between the fingers. The sensation excited, is somewhat similar to the vibration felt in drawing the point of the finger over the smooth edge of a glass. Reflecting on this circumstance, it occurred to me, that the

roughness or tremulous motion we feel in drawing a hair through the fingers in the manner I have described, may be caused by minute vibrations, which are more easily excited in one direction than another, owing to some peculiar arrangement of the particles, or of the small filaments which compose the substance of wool or hair. Whether the tendency of the hair or fibre to move in one direction when pressed, arises from a peculiar vibration, or from inequalities of its surface, it is certain, that on this its felting quality depends. This motion has been compared to that of an ear of barley placed under the sleeve of the coat, with the points of its beards downwards; by the action of the arm the ear is moved in a retrograde direction, until it has advanced from the wrist to the shoulder.

A farther illustration of this is given in an account of the process of hat-making. "When the straight hairs of the beaver, the rabbit, &c. are not intended to enter into the body of the mass, but are only to be employed in making a sort of external coating, such as is sometimes given to the outer surface of hats, the felt on which they are to be fixed being finished, the hair is uniformly spread upon the surface to which the coating is to be applied; and being covered with a cloth, it is pressed with the hands, and agitated for a certain time. By these means, the hairs introduce themselves by the root a certain depth into the felt, and are there fixed in such a manner as not to be easily extracted. If the agitation were continued for a longer time, these hairs would pass entirely through the felt, going out at the opposite surface, as each hair follows ex-

actly the direction it acquired at the beginning."

If wool and hair be formed in the manner I have before stated, many peculiarities in their growth admit of an easy explanation. Wools are generally grown finer in the winter than the summer months. During winter, sheep have not the same copious supply of food as in summer; hence the wool-forming fluid will be diminished in quantity: the cold may also be supposed to contract the ducts near the surface of the skin. Some animals produce very coarse hair in summer, the bottom of which in winter will be a fine down or fur. Many of the secreting vessels in such animals, which unite in the last duct to form hair, may probably in the cold season cease to act altogether, and only such of them as secrete the very finest part of the fluid

which forms down, may remain at that time in an active state.

Other animals inhabiting the polar regions, grow a long coarse hair, and distinct from this, a very fine short wool or down, close to the skin. The fine down seems intended to keep the animal warm, and the coarse hair to defend the down from the action of the elements, or from being worn away by the rocks and ice on which such animals repose. The fine down is secreted by smaller vessels, and probably from a finer part of the same fluid. In these animals, the formation of hair and down may proceed at the same time, as they grow from distinct vessels. The South Sea Seal produces a wool of this kind, which being buried under the coarse hair, was long neglected. It is now manufactured into cloth and shawls

by Messrs. Fryers, of Rastrick, near Halifax. These shawls exceed in softness those of Persia or India.

Thus, from the tenants of the main, the inhabitants of frozen seas, has the ingenuity of man drawn materials to contribute to his wants and luxuries, more delicate than the productions of the celebrated Vale of Cashmere.

If the above account of the formation of wool and hair be admitted, the stoppage in the growth of wool which forms a jointed staple, and also the production of stiff or cotted fleeces, may be accounted for. When from disease, but more frequently from a deficiency of food and warmth, the animal ceases suddenly to secrete the wool-forming fluid, if this continue only for a short time, and by increase of warmth and

food it again produces wool, a division in the staple will be seen, and by pulling it at each end, it will break where the stoppage in the growth took place.

Where the above causes operate for a longer time, the wool already formed having ceased to grow, and being deprived of a farther supply of yolk, is by the motion of the animal, and the action of wet, felted into a stiff cott. In some fleeces this takes place before the wool has separated from the skin: in others, the wool is nearly detached from the back, and connected only by a few scattered hairs where a languid formation of wool is going on. In some instances the formation of a new fleece has begun under that which is cotted. This takes place when the animal has again a better supply of food. The new fleece is connected with the cott by

a few hairs in each staple which had never ceased to grow. Ewes which have had more than one lamb, and have been exposed to cold and wet, or scantily supplied with food, are most liable to have their fleeces cotted.

Immediately after shearing, wool is generally formed more rapidly and coarser than during any other period of its growth. That wool grows faster at this time is acknowledged; and hence M. Fink, in his account of the sheep of Saxony, explains why sheep produce a greater quantity of wool when they are shorn twice in the year, than when they are shorn only once in the same time. The increased growth of wool after shearing, I believe arises from the pressure of the grown wool upon the secreting vessels being removed, whereby a sudden re-action and activity are

given to them, and a greater quantity of the fluid is formed. The vessels may be also more expanded and stimulated, by exposure to the rays of the summer sun. Hence, the top of the staple which was grown immediately after shearing, will in most English wool be found coarser than the bottom part. I know it may be said, that the top of the staple is that portion of wool which was close to the skin at the time the animal was shorn, and was once the finest part of the wool. But this is not true, for the points of the staple are constantly wearing away and rubbing off; it is there the wet remains, and decays the wool. This is the true cause of the brown colour at the top of the staple, which some writers have thought it difficult to explain. A minute inspection will make the truth of this apparent, for it will invariably be found, that where

the top of the staple remains discoloured after washing, a partial decay has taken place. This effect will be in a considerable degree prevented, by the first application of the ointment which I have recommended.

On examining a staple of English wool, we shall generally find, that the bottom part of it is rather finer than the upper, and the top part or point is coarser than the middle. The points were grown soon after shearing; the upper part, or rather more than half of the whole length, was grown during the summer and autumnal months; the bottom or finest part was produced after the commencement of winter, and from thence to the time of shearing. It may be objected to what I have before advanced, that if increase of food and warmth had a tendency to make wool

coarser, the part of the staple which was nearest the skin at the time of shearing, being grown in May or June, should be as coarse as the middle part, which was grown in the autumnal months. We must however recollect, that in spring the fleece has nearly acquired its full size ; and experience has informed us, that when the staple is near its usual length, the wool-forming secretions are diminished, and its growth proceeds very slowly. If a fleece remain unshorn, and continue to grow two years, the quantity of wool produced in the second year is much less than what was grown the first. Any cause which diminishes the wool-forming secretions, or in other words, the quantity of wool grown in a certain time, has a tendency to make it finer ; and hence we may learn the cause of the wool being finer at the bottom of a full grown staple, than at the

top. When the old fleece is removed, either by shearing or by falling off, new energy is given to the secreting vessels. I suspect also, that the exposure of the skin to the action of light and air, contributes something to this effect.

The direct rays of the sun in the tropical regions, appear to contract many of the pores whence the finer fibres of wool issue, and to enlarge others; thereby forming coarse hairs and kemps. I once examined the coat of a ram brought by a relation of mine from the banks of the Mississippi: it was a fine sound healthy animal, but it produced no fleece; it was thinly covered with short coarse hairs or kemps, under which there was a slight appearance of a fine down or wool: this might probably have been increased by proper management; nothing, I conceive,

would have contributed more to this effect, than keeping the surface of the skin soft by rubbing it frequently with olive oil. The animal was given away soon after I saw it, and I had no opportunity of learning the effect which change of climate might produce.

It is doubtless ordered by a wise provision of the Author of Nature, that the same animals should be adapted to live in various climates, by the changes which different situations produce in their constitutions and habits. Hence we find that sheep, when removed between the tropics, and greatly neglected by man, will in a course of time divest themselves of their useless and cumbrous fleece, and be clothed in short coarse hair. By providing them with suitable shelter, and by great attention, wool might continue to be

grown near the equator ; but I believe its best qualities would be greatly injured, unless the flocks had the advantage of ranging on very elevated mountains.

In the more temperate climate of Buenos Ayres, wool is grown of the greatest length of staple I have ever seen ; the hair was very coarse, and had been much neglected, as the fleeces were filled with the tops of a species of thistle peculiar to that country. Some of the staples measured twenty inches. There was also in these sheep a tendency to produce a very soft short wool covered by the coarser fleece. This short wool had nearly the appearance of the coarser kinds of the Vicuna wool. If we could suppose that the original breed of sheep were the same with that which I have noticed from the banks of the Mississippi, we should have a striking

instance of the effect of soil and climate upon the fleece, when removed from the fostering care of man. The effect of light and air on the furs of many animals, is well known, and it has been remarked, that men who work out of doors, with their heads uncovered, have hard, coarse hair. This may be caused by desiccation, or by the absorption of oxygen in a greater quantity through the pores of the skin. Every circumstance of this kind, if attended to, might lead us to remark the care which is requisite to cultivate the best qualities of the wool or fur, on the coats of those animals which are applied to the use man. What improvements these may admit of, we cannot conjecture, as it is only upon sheep that experiments of this kind have yet been made. If we suppose that the goat, the cat, and the rabbit of Angora, were not originally distinct

varieties of their species, it would be an object of much importance, as well as of considerable curiosity, to ascertain the circumstances of soil, of climate, and of treatment, which gave to these animals a long coat of such peculiar softness. It seems still uncertain, whether the shawls of Persia, and of India, are fabricated from the produce of the goat or the sheep. An expedition to obtain some of these animals, would offer a richer prize to our manufacturers, than the acquisition of the golden fleece; for British industry would soon convert the wool into fabrics of more value than their weight of the purest gold.

The finest wools of Europe, cannot in the least compare in softness with the Asiatic fleece.

Mr. Luccock is entitled to praise for

for suggesting that the coats of many tame and domestic animals might, like that of the sheep, be applied to the service of the loom. The sneer of assumed sapience may be excited by this suggestion, accompanied with the exclamation, "What! shear wool from the backs of bulls and asses! Was ever any idea so preposterous." Let us, however, bear in mind, that the horizon of ignorance is as contracted as the narrow bounds of its own limited experience; every thing beyond this is considered as absurd or impossible. Had these sapient sneerers lived in a period prior to the application of the labours of the silkworm to the luxury or the convenience of man, with what contempt would they have treated the observer of Nature, who having remarked some of the properties of silk, and anticipated its use, had hence ventured to predict, that in some future

age, the imperial purple, the royal mantle which was to invest the shoulders of the mightiest potentates, would be fabricated from the cobweb of a grub. There is indeed no instance in the history of human industry, which would at the first sight appear more surprising than the application of this substance to the service of man.—Instead of allowing ourselves to believe that what has been already done by ingenuity and perseverance is all that can be accomplished, we should rather contemplate the experience of former times, as affording us imperfect hints, which if properly attended to, may lead to future improvements, and to discoveries of still greater importance.

Amongst the animals which seem suited to our climate, I would recommend an attention to the varieties of the Pacos and

Vicuna. Some of these are nearly white, and I have little doubt, would, with proper attention, grow a fleece free from the long coarse hair with which its downy coat is frequently intermixed. The wool when clear from these hairs, would be worth 30s. per pound ; and the flesh, if we may judge from the appearance of the animal, would be equal to venison.

A grazier in Leicestershire, who is also a dealer in wool, has observed that some of the Scotch cattle have upon their backs, what he called “ soft woolly tufts of hair ;” and he further noticed, that the cattle which had these tufts throve better than others, and he always gave them the preference when purchasing his stock. If such varieties were attended to, and promoted, probably we might obtain from them a valuable addition to the materials on which

national industry might be profitably employed. Nor can this be thought improbable, if we recollect, that a breed of oxen is said to exist in Hudson's Bay, which produces a wool finer and softer than that of the Vicuna. We know already that the coat of the latter animal, and of the goat, the rabbit, and of the amphibious seal, have been spun and wove into cloths and shawls, some of which were of greater value than any ever produced from the wool of European sheep.

In a former Chapter, I have noticed the effect of increase of food on the qualities of wool. If the Spanish sheep resist this effect longer than the English, it may arise from the peculiarity of its constitution, whereby the increase of nourishment is applied more to fattening the animal, and the production of yolk, than to the secretion

of the wool-forming fluid ; or its pores may more firmly resist dilation from the impetus of increased secretion ; the staple of the wool may thus be grown longer, but the hair may continue equally fine. The effect of heat, light, and air, in increasing the secretions, and dilating the excretory ducts, and thus forming coarse kemps, might be explained in the same manner ; and also many other peculiarities attending the growth of hair and wool ; but I have already extended this article beyond my original design.

Before I conclude, it will, however, be proper to reply to an objection which may be made, against what has been here advanced respecting the structure and formation of hair and wool. I have stated their substance to be similar to that of feathers. In the latter, there is evidently a circulation and secretion carried on until the fea-

thers have obtained their full size. This objection will be removed by an attention to the difference in the structure and growth of each. Hair or wool, when first protruded through the skin, is perfectly formed, and each part of it is of the same size which it ever after retains. But it would be impossible for any portion of the feather to be formed full grown and perfect within the skin. A tube or stem first appears, from which the other parts afterwards shoot forth, and are supported and increased by circulating fluids from the parent bird. When the extremities of the feather are fully formed, they become indurated, the smaller vessels close up, and the circulating fluids recede lower and lower down, until they are at length denied all farther entrance into the quill.

Such I apprehend to be the process of

Nature, and that this entire cessation of the accustomed secretions occasions the disease which we call the moult. This is probably a species of fever. The bird loses its cheerfulness and relish for food, and is seized with sudden shiverings. The disease continues until the old feathers fall off, when the secretions are again renewed, by which the bird is restored to health, and acquires a renovated plumage.

Hair is as fully and perfectly formed after it leaves the skin as the extremity of the feather in its most mature state ; it appears to grow merely by the addition of new hair at the bottom, which protrudes it forward. On the contrary, feathers, and all bodies which grow and increase from interior circulation, not only grow from the upper part, but continue to enlarge in every dimension until they are full grown. The

difference between the growth from the top and sides of the feather, and the elongation by mere juxtaposition at the bottom of the hair, appears to me clearly to indicate the different modes of their formation. It may tend to confirm the opinion I have advanced respecting the structure of hair and wool, that hair is frequently observed to split at its points into different fibres; a division has also sometimes been seen in the hair of wool. This seems to prove that they are formed by a number of distinct long filaments uniting in one thread or hair, as I have described. It is not, however, on hypothetical reasoning that I rest the proof of this opinion. I have ascertained its truth in some instances, by an examination of the hair of different animals, both with the single and compound microscope. In large hairs I have discerned a number of divisions from

the root to the point. In one hair I distinctly perceived fifteen of these divisions or fibres laying parallel to each other, and in some of the fibres a further subdivision was distinguishable. Probably these subdivisions were each composed of others still smaller, which the limited power of our instruments may prevent us from discovering. If such be the structure of the hair of some animals, it is at least probable the hair of all others may have a similar conformation; although the fibres of which they are composed may be too minute, or adhere too firmly together, to admit us to separate or distinguish them. It were almost needless to add, that wool, whatever may be its peculiar qualities, is still the hair of sheep, and must be formed by a process of the animal economy similar to what produces the hair of all other quadrupeds. I might offer as a farther

confirmation of what has been here advanced, that it may be fairly inferred from wool and hair remaining long after they are separated from the skin without any perceptible change, that they have not been deprived of any secretions from the circulating fluids by this separation.

Whether wool be composed of tubes and vessels receiving increase by constant circulation and secretion of fluids from the animal, or whether, like the silk-worm's web, it be a solid unorganized thread, composed of finer filaments, may appear a question more curious than important. But if the latter opinion be well founded, which both deductions from analogy and the minutest microscopical researches render probable, it will lead to consequences of considerable practical utility, and teach us to bestow more care and attention on the unshorn fleece. Nature, when she produces

wool, provides for it, and covers it with an oily secretion, or yolk, and thus intimates that she has confided its future defence and preservation to external applications. When, from accidental circumstances of situation, this yolk is absorbed, or its copious secretion is prevented, she has given us the power of supplying the deficiency, of assisting her intentions, and improving her operations, by the application of ointments better suited to resist the effects of soil and climate. Thus by attending to the intimations of Nature, man is enabled in Northern latitudes to cultivate and bring to perfection, both the animal and vegetable productions of Southern and more favoured regions*.

* In offering my remarks upon Mr. Bakewell's work, I have strictly confined myself to such parts of the subject as fall more immediately under my own observation and practice, and endeavoured to recon-

cile what might appear at first sight contradictory, or to militate against old established usage. This Treatise has brevity and much ingenuity to recommend it; regardless of profit, or indeed any remuneration for his labour, the Author has no other object than to call the public attention to this neglected, but most important branch of rural economy. How nearly it is connected with the success of our finest woollen manufactures, and how much the national revenue may be affected thereby, it is needless here to dwell on. Under such circumstances, I did not think myself justified in refusing any little assistance which my pursuits might enable me to render,—S.

APPENDIX.

MY Brother, Mr. John Bakewell, of Nottingham, who is well acquainted with the wools of Derbyshire, informs me that the fleeces in the limestone districts, are less frequently cotted or stiff, than those of the same kind in Leicestershire and the adjoining counties, which he is inclined to attribute to the soil. This tends to confirm what I have advanced, for we know that lime injures the felting quality of wool, and it is to this quality that I refer the cause of wool being cotted or stiff, when it remains on the back of the animal after the stoppage of its growth. It may perhaps appear extraordinary to those accustomed to observe the effects of

lime as a chemical agent in its caustic state only, that so much should be attributed to its operation, when in the carbonated or mild state in which it exists under the form of chalk, limestone, or marble. It is however well known, that the fixed alkalies, soda, and potash, and the alkaline earths, possess, as carbonates, though in a less degree, many of the same properties which they have when deprived of the carbonic acid, and rendered caustic.

The action of calcareous earths upon the fleece, will depend, as I have before stated, on the quantity which exists in a loose state near the surface of the soil, and in proportion to the different degrees of induration in which they occur, whether as chalk or limestone. Where limestone is very hard, and lies deep under the surface, as stated by Lord Somerville (vide

his Note, pages 4 and 5), it can do little or no injury to the fleece. In Derbyshire, and other calcareous districts, the limestone frequently penetrates the surface of the soil, and lays exposed to the action of light and moisture, by which it is constantly softening and wearing down. Some of the limestone hills in Derbyshire are composed of loose shells, which may be separated from each other, proving their submarine origin.

Other masses of the same earth are consolidated into a perfect marble. The effect of limestone in these different states upon the wool, I have no doubt would vary considerably ; and I feel myself much obliged to his Lordship for pointing out the distinction, to which I had not sufficiently adverted. It is scarcely necessary to add, that this difference is caused by the greater

facility with which the particles of lime are broken down, and insinuate themselves into the fleece. For the same reason also, grass lands must always be less injurious to the soft quality of wool, than fallows or ploughed fields on the same kind of soil. The Merino, or Spanish breed of sheep, would resist the deteriorating effects of limestone or chalk, more than any of our native flocks, both on account of the closeness of its pile, and the copious covering of its yolk, which prevent the particles of the soil from penetrating the fleece, and coming in contact with its fibre. This proves the propriety of the practice I recommend, to supply the fleeces, with an artificial defence where the natural secretions are deficient, which is the case with almost all our English sheep. The advantage which the Merino sheep possess from the fineness of its hair. the closeness of its

pile, and the quantity of its yolk, gives it a decided preference, as a wool-bearing animal, to any of our fine-woolled sheep. How far it may be inferior to them in the carcass, and the facility with which it can be made fat, is not for me to decide. That they may be kept in any dry situation in our Island, and by providing them with occasional shelter in summer and winter, and by limiting the quantity of food, may be made to produce wool of the best quality, I have no doubt. It might however be desirable in the Northern parts of England, to prefer an importation of the Saxon breed, because they have been long accustomed to a climate more resembling our own.

It has been remarked of the Merino breed, that the sheep do not cast their fleeces annually; the wool continues to

grow three years, or perhaps for a longer time, and the quantity grown in each of the second and third years, is said to equal that of the first. Is this peculiarity a mark of a distinct race, or does it arise from the sheep being removed into a cold temperature? This can only be determined by an accurate knowledge of the habitudes of the animal before its removal into more northern latitudes. I am inclined to believe, that a certain degree of fever in the animal system, always precedes, and occasions the casting of the fleece. This fever is caused by excessive heat, or by the stoppage of the wool-forming secretions, similar to what I have stated with respect to the moult in birds. In countries where the practice of shearing was unknown, this fever was produced by art, in order to separate the wool from the skin. For this purpose, the sheep were closely confined

without food, in warm rooms; the animal experienced thereby a temporary disease, which loosened the wool, and enabled the shepherds to tear it from the backs of his flock.

Whilst the preceding Chapters were in the press, Mr. Harding, my bookseller, placed in my hands, Dr. Anderson's Account of Sheep, &c. published in 1794, which I had not before seen. In this work, Dr. A. has stated, that the falling off, and the growth of the whole fleece nearly at one time, and the loss of the coats of other animals by separate hairs, forms a characteristic distinction between wool and hair. I am surprised it should have escaped this attentive observer of Nature, that the hairs of all fleeces are so intermixed, and in some degree felted together, that it is impossible for them to fall off until they

are nearly all detached from the skin. Even the short kemp hairs which have been long separated from the back, adhere to and remain in the wool. Were the hairs of other animals equally long and flexible, they would fall off, and appear to grow as regularly as those of the sheep. If we attempt to draw out a single hair from a shorn fleece, we shall find that it cannot be done without breaking it, unless we carefully hold the other end of the staple.

Dr. Anderson's opinions respecting the influence of heat in making wool coarser, agree nearly with what I have stated ; but he appears, in his accounts of its effects on the fineness of the fibre at different seasons of the year, to have overlooked another cause operating at the same time ; I mean the increase and decrease of food.

The difference in the quantity of nourishment which sheep generally obtain in the summer and winter months, will contribute to the variation he observed in the fineness of wool grown at these different seasons.

I have stated circumstances, in which wool will be grown even finer in a mild than in a severe winter; namely, when sheep have been left to provide for themselves, and have not been supplied with their usual and necessary food. At such times, though wool will be grown finer, the soundness of its fibre is injured. Dr. Anderson's opinions agree with mine, that wool and hair grow by protrusion. He is inclined to deny the power of hot climates to cause sheep to change the fleece for short, coarse hair. It may require a succession of generations to effect an entire

change in wool-bearing animals, but I am inclined to believe it takes place where they are neglected by man, and exposed to a burning sun ; for I cannot admit that the ram without wool, from the banks of the Mississippi, which I have mentioned, was of a distinct race from our European sheep ; in appearance, it exactly resembled our Wiltshire sheep.

The action of light upon the skin appears to increase the coarseness and hardness of wool, and I believe it will be found, that a fibre of wool or hair which has been covered during its growth, will be always finer and softer in the same temperature and circumstances, than that which has been grown when the skin was exposed to the immediate action of the solar rays. Hence we find, that the softest furs and downs are grown under the shade and co-

vering of long coarse hair ; and the skin of the abortive lamb, on which the light and air have never acted, is considered by some nations as the most valuable fur, on account of the superior softness of its fleece. To obtain the skin in this state, the unnatural practice of killing the ewe near the time of yeaning was resorted to.

In recommending the wool of the Spanish breed of sheep in England to be clean washed on the back of the animal, I omitted to state a circumstance well deserving attention. From trials which I have seen of its manufacture, I am inclined to suspect that the soundness of its fibre had been sometimes injured by lying pressed in a pile in the unwashed state. It is well known to woollen manufacturers, that wool or cloth moistened with animal oils, and thrown into a heap, very soon becomes

hot by the commencement of the putrefactive fermentation, whereby its soundness is injured; sometimes a spontaneous combustion will ensue.

We should recollect, that the unwashed Merino wool contains more than one half of its weight of extraneous matter, which, however beneficial it may be to the wool on the back of the animal, may be liable to ferment when pressed into a solid mass. It will be still more so, if, in addition to this, any aqueous moisture be contained in the fleece.

Having had frequent occasion to mention the flocks of Northumberland in the preceding Chapters, I cannot conclude without expressing my regret at the great losses which the farmers have sustained by the late severe winter of 1807-8. Many of

them, I am informed, have been deprived of more than half their flocks. The ointment with which they are covered, is an excellent defence against the inclemency of the season, but it cannot avail against the continued and combined effects of cold and hunger, when sheep are buried for many weeks under immense drifts of snow. There are, however, some instances in which they have been brought out alive, after having been ten or fifteen days in this miserable state of confinement.

Both interest and humanity call upon the farmers to provide some shelter for their flocks during the severity of winter. I trust the efforts which Lord Somerville has for some time made to awaken the Northern farmers from their supineness, will not be in vain. It is not only in the Northern counties, but in every part of our

Island, that more attention is required to provide occasional shelter against the inclemencies of the climate, both for sheep and all other animals which are exposed in the fields. In proportion as they are made comfortable, will be their tendency to improve; and it is not only our interest, but every humane man must feel it a duty, to provide for the comfort of those animals which are entrusted to his care. In the Northern districts such attention seems absolutely necessary. The farmers in the Midland and Southern counties can scarcely form an idea of the tremendous wintery storms which sweep over the Cheviot hills, and the wild fells of Cumberland and Westmoreland, or the still bleaker mountains of Scotland. At such times the Heavens are darkened with descending snows, and sleet driven by furious gusts of wind, which compel the sheep to seek protection

in hollows and glens near the bottom of the mountain. Suddenly an impetuous blast uplifts whole fields of snow from its shelving sides above, and driving aloft in tumultuous whirl, precipitates the contents on the miserable flock, which are in a moment buried deep under the surface. In vain may the shepherd try to trace them over a driving expanse of snow: were he to attempt it, he might share the fate of his flock. But all effort of this kind is fruitless; for the summits, the sides, and the very base of the mountain, “are involved in tempests and a night of clouds,” which bury every object in impenetrable gloom. Sometimes these immense volumes of rolling vapour dispart, and open for a few moments to disclose the horrors of the scene. The shepherd, mindful of his own safety, returns home, and day after day, awaits the hour when he may wander out

safely in search of his flock ; whilst they in the mean time, sickening with hunger and perishing with cold, are at last relieved by death from their long protracted misery. Thus have perished during the last winter many thousand sheep in Northumberland, and other northern parts of our Island. The owner, whilst he wanders over these wild and melancholy wastes, and observes his thinly scattered flocks, may perhaps murmur at the order of Nature : let him rather accuse his own supineness, and learn at length to profit by the lessons of a dearly purchased experience.

POSTSCRIPT.

It appears from M. Lasteryie's *Histoire de l'Introduction des Moutons, &c.* that in every part of the Continent of Europe to which the Spanish sheep have been transported, it has been found necessary to provide them with suitable shelter against the severity of winter, and to defend them from heavy rains and extreme heat. In proportion to the attention of the shepherds to these objects, has been the preservation of the best qualities of the fleece. The sheep-houses should be built in a dry situation, be kept clean, and admit light and air in different directions, at pleasure; they should also be well paved, and sufficiently spacious for the easy accommodation of the flock. In Denmark, there is a small enclosure to the south of the sheep-house, into which

the sheep can walk when the weather is too severe to admit of their being led to the distant fields. The racks in which their fodder is placed, have vertical bars, to prevent the dust and seeds from falling into the wool, which must be the case where the racks are inclined. This is a summary account of M. Lasteyrie's observations on the subject, which deserve the attention of the English farmer, whatever may be the breed of sheep he is desirous to improve. If our winters are more mild than those under the same latitude on the Continent, our rains are more frequent and abundant, and are more prejudicial both to sheep and wool than intense cold.

My readers must excuse me for introducing in this place (it should have been inserted in Chap. IV.) a recommen-

dation to wool-growers, to attend with great care to the preservation of their fleeces from an intermixture with black, brown, or grey hairs, which render the wool inapplicable to many purposes of the woollen manufacture, and lessen its value considerably. Many of our native fleeces, particularly the Norfolk, Sussex, and Wiltshire, have this defect. It might be avoided by proper care and attention in selecting the stock. I am much surprised that a race of black sheep is suffered to exist in any of our Merino flocks. The slightest appearance of a tendency to produce discoloured wool, should be shunned like a contagious distemper. Such was the attention of the ancient shepherds of Italy to preserve the pure whiteness of their wool, that they did not trust to the colour of the fleece alone, but carefully examined the mouth and tongue of the ram: and if the least black-

ness or swarthinness appeared, he was immediately rejected from the flock, that he might not communicate the colour to the fleeces of the lambs.

“ Illum autem, quamvis aries sit candidus ipse,
 “ Nigra subest udo tantum cui lingua palato,
 “ Rejice, ne maculis infuscet vellera pullis
 “ Nascentum.”———

GEO. III. line 387, &c.

Pliny also relates, that the mouths of the rams were particularly examined, because the colour of the veins under the tongue, indicated what would be the colour of the lamb. If these were of different colours, the fleeces would be spotted.

“ Arietum maximê spectantur ora; quia cujus coloris sub linguâ habuêre venas, ejus et lanicium est in fœtu: variumque si plures fuêre.”—*Plin. H. N. lib. viii. c. 47.*

It is highly probable that the Roman

and Tarentine breeds of sheep, to which this precaution was applied, were the parent stock from whence the present race of fine-woolled sheep in Spain derive their origin.

There would be more good sense than pedantry, in attending to the advice of the ancient poet and naturalist, and adopting the same precaution, when the rams of our Merino or native breeds are selected by our own shepherds to continue their race. I have no doubt that an appearance of blackness in any part of the animal, indicates a tendency to produce black wool in itself or its progeny, and should be carefully marked and avoided by the wool-grower.

Amongst other causes injurious to wool, it is not a little remarkable, that Virgil should expressly caution his shepherds against "rich pastures." Their effects on

the fleece must have been known at the time, for we cannot suppose that the caution originated in prejudice, as the opinion is confirmed by the experience of the present day.

“ Si tibi lanicium curæ; —————

“ ————— —fuge pabula læta.”

There is, however, an easy method, by which the richest pastures, if dry, may be favourable to the growth of the finest wool. I have stated this in Chap. IV. It consists in hard stocking the ground, so that the sheep can obtain no more than their usual quantity of nutritious food. I believe it will invariably be found, that whenever sheep have been removed suddenly from a bare to a very rich pasture, without any perceptible alteration taking place in the fineness of the wool, that the practice of hard stocking has been resorted to.

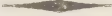
Every one interested in the improvement of wool, will look forward with some impatience to the publication of Lord Somerville's Statement of the Experiments he has made on this subject on a very extensive scale.—See his Lordship's Note, p. 82.

The Author has had the satisfaction to receive a confirmation of the truth of his opinion respecting the effects of heat on sheep, in the following Letter from a Friend (June 9, 1808) :—“ In conversation with Capt. Goodall, whose connection with St. Domingo you may have learned from the newspapers, he mentioned some particulars respecting two ewes, which corroborate the opinion that you are going to publish upon the effect of excessive heat on the fleece. These animals, soon after their arrival on the island, became languid and sickly, lost their wool, and in twelve

months a harsh, sparing crop of hair was observed on them."

I have in the preceding parts of this Treatise, adverted to the manner in which I suppose this change is produced, by the action of heat and light on the wool-forming vessels near the surface of the skin. Lord Somerville's account of the effect of heat on the wool of his Merino flocks, even in our temperate climate, is a farther illustration of the truth of what I have advanced on this subject. (See Note, p. 25.) The practical inference to be made from both these instances, is obvious. It evinces the advantage which must arise from keeping sheep in cool and shady situations during the heat of summer, particularly after the time of shearing. The natural instincts of the animal, if attended to, would teach us the propriety of providing the flock with a shade and defence against

the fervid rays of a meridian sun in the three summer months.



The experiments of M. Ivard, in 1800, made in France on four Merino sheep, tend to prove, that where the fleece is suffered to grow more than one year, the quantity of wool produced is less than when the animal was shorn twice in the same time. These experiments agree with the observations of M. Fink, made in Saxony, and accord with what takes place on almost every other breed of sheep on which the same experiments have been made. They are however at variance with the results of M. Gilbert's experiments on a part of the Merino flock at Rambouillet. The method adopted by M. Ivard, appears from its accuracy to have the preference. Four lambs were selected and shorn during the first

and second year on one-half of the body, in a direction from the head to the tail. The part of the fleece which covered the other half, was shorn at the end of the second year. The total advantage of the annual shearing on the four sheep, compared with the biennial, was two pounds seven ounces and a half. The manner in which these experiments were made, may suggest a very accurate method of ascertaining the benefit which wool would receive from the practice of greasing. If a score sheep were selected, and ten of them rubbed with the ointment on the right half of the animal, the remainder on the left, and submitted to the same treatment in other respects, the effect on the wool might be accurately proved by dividing the fleeces, then sorting them by a skilful wool-sorter, scouring each sort perfectly clean with soap and warm water, and sub-

mitting them to the inspection of the best judges. It might be ascertained more fully by manufacturing the separate sorts of each kind. I apprehend the weight of the wool which had been greased, would exceed the other when both were clean scoured. This experiment would be defective, as far as it regards the advantage which the animal itself derives from the ointment during the winter months.

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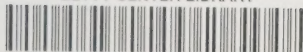






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